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ELECTROTECHNICAL VOCABULARY

PART III ACOUSTICS

Section 5 Speech and Hearing

UDC 001·4 : 534·8

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Indian Standard
ELECTROTECHNICAL VOCABULARY

PART III ACOUSTICS

Section 5 Speech and Hearing

0. FOREWORD

0.1 This Indian Standard (Part III/Sec 5) was adopted by the Indian Standards Institution on 19 December 1966, after the draft finalized by the Electrotechnical Standards Sectional Committee, in consultation with the Acoustics Sectional Committee, had been approved by the Electrotechnical Division Council.

0.2 This Indian Standard has been prepared in view of the frequent need for definitions to be included in the different documents on amplifiers, loudspeakers and other related acoustic equipment, and with a view to bringing together the terms used in the field of acoustics. It has been decided to prepare this terminology in a number of sections, each dealing with a particular aspect of the subject.

0.2.1 This section covers terms relating to speech and hearing.

0.2.2 The following other sections have so far been prepared:

Section 1 Physical acoustics
Section 2 Acoustical and electro-acoustical transmission system
Section 4 Sonics, ultrasonics and underwater sound.

0.2.3 The following other sections are under preparation:

Section 3 Sound recording and reproduction
Section 6 Acoustical instruments.

0.3 While preparing this standard, attempt has been made to follow, as far as possible, the definitions proposed by the International Electrotechnical Commission in their Pub 50(08)-1960 Electro-acoustics.

0.3.1 Assistance has also been derived from the following:

B.S. 661 : 1955 Glossary of acoustical terms. British Standards Institution

ASA S 1.1-1960 Acoustical terminology including mechanical shock and vibration. American Standards Association.

0.4 The electrotechnical vocabulary is being prepared in several parts, each having one or more sections. A list is given on fourth cover page.

1. SCOPE

1.1 This standard (Part III/Section 5) covers terms relating to speech and hearing.

2. TERMINOLOGY

2.1 Pitch — The attribute of auditory sensation in terms of which sound may be ordered on a frequency scale extending from low to high. Pitch primarily depends upon the frequency of the sound stimulus, but it also depends upon the sound pressure and waveform of the stimulus.

> NOTE — The pitch of a sound may be described by the frequency or frequency level of that simple tone having a specified sound pressure level which is judged by listeners to produce the same pitch.

2.2 Mel — A unit of pitch. A pitch of 1 000 mel is produced by a pure tone of frequency 1 000 c/s, 40 dB above the threshold of hearing. The pitch of any sound judged by listeners to be *n* times that of one mel tone is *n* mels.

2.3 Timbre — That subjective attribute of a sound which enables a listener to judge two sounds having the same pitch and loudness to be dissimilar.

> NOTE — Timbre depends primarily on the spectrum of sound, but it also depends on the waveform, the sound pressure, the frequency location of the spectrum and the temporal characteristics of sound.

2.4 Tone

a) A sound wave capable of exciting an auditory sensation having a pitch.
b) A sound sensation having a pitch.

2.5 Pure Tone — A sound in which sound pressure varies sinusoidally with time.

2.6 Warble Tone — A tone whose frequency varies periodically about a mean value.

2.7 Subjective Tone — An aural sensation of a tone of a particular frequency in the absence of a stimulation by sound of that frequency.

> NOTE 1 — A subjective tone may arise from beats between pure tones.
>
> NOTE 2 — A subjective tone may be used to denote the sensation of sound generated within the ear.
>
> NOTE 3 — A subjective tone which is the harmonic of a stimulus tone is called ' Aural Harmonic '.

2.8 Combination Tone — A tone produced by non-linear relationship between the response and the stimulus in the ear (that is, as a subjective tone) or in a transducer due to two sinusoidal components in the stimulus.

2.9 Difference Tone — The combination tone whose frequency is the difference between the frequencies of the two stimulating (generating) tones.

2.10 Summation Tone — The combination tone whose frequency is the sum of the frequencies of the two stimulating (generating) tones.

2.11 Loudness — That attribute of the auditory sensation in terms of which sounds may be ordered on a scale extending from soft to loud.

NOTE — Loudness depends primarily upon the sound pressure of the stimulus but it also depends upon the frequency and the waveform of the stimulus.

2.12 Loudness Level — The median value of the sound pressure level of a standard pure tone (1 000 c/s) which is assessed by a large number of normal observers as being equally loud.

NOTE — The manner of listening to the unknown sound shall be stated.

2.13 Phon — The unit of loudness level. It is numerically equal to the sound pressure level in decibels of the standard pure tone (1 000 c/s).

NOTE 1 — The standard pure tone of 1 000 c/s is produced by a sensibly plane progressive sound wave coming from directly in front of the observer.

NOTE 2 — The reference sound pressure level is 2×10^{-5} N/m^2 ($= 2 \times 10^{-4}$ dyn/cm^2)

NOTE 3 — The observer is listening binaurally.

2.14 Loudness Level Contour — A curve showing the related values of sound pressure level and frequency required to produce a given loudness sensation.

2.15 Sone — The unit of loudness on a scale designed to give scale numbers approximately proportional to the loudness.

NOTE — The scale is defined by its relation to the phon scale given by the formula:

$$\text{Phon} = 40 + 10 \log_2 (\text{Sone})$$

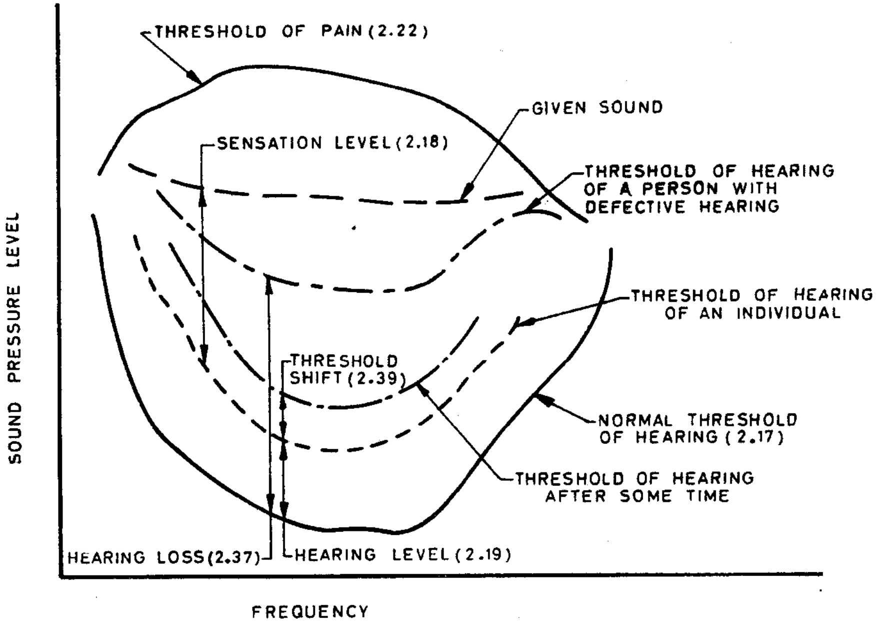
2.16 Threshold of Hearing (Threshold of Audibility) — The minimum rms value of the sound pressure of a specified sound which excites the sensation of hearing in a specified fraction of trials on an individual subject (*see* Fig. 1).

NOTE 1 — Unless otherwise indicated, the ambient noise reaching the ears is assumed to be negligible.

NOTE 2 — The threshold is usually given as sound pressure level in decibels above 2×10^{-5} N/m^2.

NOTE 3 — Instead of the method of constant stimuli, which is implied by the phrase 'a specified fraction of trials', another psycho-physical method (which should be specified) may be employed.

2.17 Normal Threshold of Hearing — Modal value of the thresholds of hearing of a large number of otologically normal subjects between 18 and 25 years of age (*see* Fig. 1).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HEARING LEVEL (2.19)
SOUND PRESSURE LEVEL
FREQUENCY

FIG. 1 AUDIBILITY CURVES

2.18 Sensation Level (Level Above Threshold) — The sound pressure level of a specified sound in decibels above the threshold of hearing of an individual subject (*see* Fig. 1).

2.19 Hearing Level — A measured threshold of hearing of an individual subject expressed in decibels relative to the normal threshold of hearing (*see* **2.17** and Fig. 1).

2.20 Threshold of Feeling (Tickle) — The minimum rms value of the sound pressure level of a specified sound which stimulates the ear to a point at which there is a sensation of feeling (tickle) that is different from the sensation of hearing.

2.21 Threshold of Discomfort — The minimum rms value of the sound pressure level of a specified sound which stimulates the ear to the point at which the sensation of feeling becomes uncomfortable.

2.22 Threshold of Pain — The minimum rms value of the sound pressure level of a specified sound which stimulates the ear to a point at which discomfort gives way to definite pain (*see* Fig. 1).

2.23 Auditory Sensation Area — The region enclosed by the curves defining the threshold of pain and the threshold of audibility as functions of frequency.

2.24 Noise Level — The weighted sound pressure level of a noise. The weighting network employed (A, B or C) shall be stated.

2.25 Perceived Noise Level — The sound pressure level of a reference sound which is assessed by normal observers as being equally noisy.

NOTE — The reference sound consists of a band of random noise between one-third and one octave wide centred on 1 000 c/s.

2.25.1 *PN dB* — The unit of perceived noise level. It is numerically equal to the sound pressure level of the reference sound expressed in dB above 2×10^{-5} N/m^2.

2.26 Noy — A unit of noisiness related to the perceived noise level in PN dB by the expression:

$$\text{PN dB} = 40 + 10 \log_2 (\text{Noy})$$

NOTE — This expression is analogous to the relation between phon and sone.

2.27 Noise Rating Curves — An agreed set of empirical curves relating octave band sound pressure level to the centre frequency of the octave bands, each of which is characterised by a ' noise rating (NR) ' which is numerically equal to the sound pressure level at the intersection with the ordinate at 1 000 c/s. The ' noise rating ' of a given noise is found by plotting the octave band spectrum on the same diagram and selecting the highest noise rating curve to which the spectrum is tangent.

2.28 Speech Interference Level — The average of the sound pressure levels of a noise in octave bands centred on the frequencies 500, 1 000 and 2 000 c/s together with the frequency 250 if the sound level in this band exceeds the others by 10 dB or more.

2.29 Monaural Hearing — The perception of sound by the stimulation of a single ear.

2.30 Binaural Hearing

a) Normal perception of sound and its directions of arrival with both ears.

b) By extension, the perception of sound when separate electro-acoustic transmission channels are connected to the two ears.

2.31 Diotic Hearing — The simultaneous stimulation of the two ears by the same sound.

2.32 Dichotic Hearing — The simultaneous tonal stimulation of the two ears with different sounds which may be components of a single sound.

2.33 Stereophony — A process designed to produce the illusion of a spatial distribution of sound sources by using two or more channels of information.

2.34 Double Channel Listening — Perception of sound by both ears when these are separately stimulated in such a way as to simulate natural binaural hearing.

2.35 Cocktail Party Effect — The faculty of selecting one stream of information out of a number of voices speaking at the same time.

2.36 Haas Effect — An effect concerned with the apparent location of the source when the same sound is heard from two or more sources (as in a public address system). Within certain limits of the relative intensities of the separate sounds and of the time intervals between their arrivals the sound appears to come from a single source, namely, that from which the sounds first arrive, even though the later sounds are more intense.

2.37 Hearing Loss — The difference between the threshold of hearing level of an individual subject and the normal threshold of hearing which is ascribed to specific cause or causes (*see* Fig. 1).

NOTE — Hearing loss is a function of frequency.

2.38 Audiogram — A graph showing hearing loss as a function of frequency.

2.39 Threshold Shift — The deviation, in decibels, of a measured hearing level from one previously established (*see* Fig. 1).

NOTE — Qualifying adjectives — temporary or permanent — are usually associated to indicate the nature of the shift (*see* **2.40** *and* **2.41**).

2.40 Temporary Threshold Shift — That component of threshold shift which shows progressive reduction with the passage of time when the apparent cause has been removed.

2.41 Permanent Threshold Shift — That component of threshold shift which shows no progressive reduction with the passage of time when the apparent cause has been removed.

2.42 Air Conduction — That process by which sound is conducted to the inner ear through the air in the outer ear canal as part of the pathway.

2.43 Bone Conduction — That process by which sound is conducted to the inner ear through the cranial bones.

2.44 Bone Conduction Hearing Level — A measured threshold of hearing by bone conduction excitation, expressed in decibels, relative to that specified as normal.

2.45 Occlusion Effect — The lowering of an individual's bone conduction hearing level when the normal air transmission along the meatus is impeded.

2.46 Recruitment — Abnormal rapid increase of subjective loudness as a function of sound pressure level.

2.47 Masking

a) That process by which the threshold of hearing of one sound is raised due to the presence of another (masking sound).

b) The increase, expressed in decibels, of the threshold of hearing of masked sound due to the presence of the masking sound.

2.48 Masking Audiogram — A graphical representation of masking due to the stated sound. This is plotted, in decibels, as a function of frequency of the masked tone.

2.49 Electrophonic Effect — The sensation of hearing produced when an alternating current of suitable frequency and magnitude from an external source is passed through a person.

2.50 Critical Band (Aural Critical Band) — A band of frequencies centred around a nominal frequency which produces the same masking effect as a wider band of equal spectrum level.

2.51 Recognition Differential — For a specified aural detection system, that amount by which the signal level exceeds the noise level presented to the ear when there is a 50 percent probability of detection of the signal. The bandwidth of the system, within which signal and noise are presented and measured, shall be specified.

NOTE 1 — The signal and the noise need not be measured actually at the ear, but may be measured at any convenient point in the system, provided it is established that the difference between the signal level and noise level at that point is the same that at the ear.

NOTE 2 —The psycho-physical method chosen for testing the probability of detection shall adequately control errors of commission as well as those of omission.

2.52 Difference Limen (Differential Threshold) — (Just Noticeable Difference) — That increment in a stimulus which is just noticed.

2.52.1 *Relative Difference Limen* — The ratio of the difference limen to the absolute magnitude of the stimulus to which it is related.

NOTE — The applicabilities to individual subject or group of subjects should be qualified while specifying the values.

2.53 Instantaneous Speech Power — The rate at which acoustic energy is radiated by a speech source at any given instant.

2.54 Peak Speech Power — The maximum value of instantaneous speech power in a given time interval.

2.55 Average Speech Power — The average value of the instantaneous speech power in a given time interval.

2.56 Articulation and Intelligibility Percentage (Discrimination Score for Speech) — The percentage of speech units spoken by a talker is correctly repeated, written or checked by a listener or listeners.

NOTE 1 — The word ' articulation ' is used when the units of speech material are meaningless syllables; the word ' intelligibility ' is used when the units of speech are complete, meaningful words, phrases or sentences.

NOTE 2 — The kind of speech material shall be mentioned, that is, syllables, words, etc.

NOTE 3 — The percentage articulation or intelligibility is a property of the entire communication system, that is, talker, transmission equipment medium and listener.

2.57 Formant — A band of frequencies in the spectrum of a complex sound which may be associated with a resonance in the mechanism of the production of sound.

NOTE 1 — Vowel sounds may possess more than one formant in different parts of the spectrum.

NOTE 2 — The term may also be used in relation to musical instruments.

2.58 Visible Speech — Display of speech energy in terms of time, frequency and intensity.

2.59 Auditory Fatigue — Under consideration.

2.60 Speech Audiometry — Under consideration.

2.61 Speech Reception Threshold — Under consideration.

2.62 Speech Discrimination Test — Under consideration.

(*Continued from page 2*)

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IS : 1885 (Part III/Sec 5) - 1966 ELECTROTECHNICAL VOCABULARY

PART III ACOUSTICS

Section 5 Speech and Hearing

Addendum

(*Page* 10, *clause* **2.62**) — Add the following new clauses after this clause:

'**2.63 Screening** — The process of dividing a group of individuals into two sub-groups according to whether they do or do not have hearing threshold levels greater than certain minimum values at one or more specified frequencies.

2.64 Equivalent Threshold Sound Pressure Level (Monoaural Earphone Listening) — Of an ear at a specified frequency and for a specified type of earphone and for a stated force of application of the earphone to the human ear. Sound pressure level set up by the earphone at that frequency in a specified artificial ear or coupler when the earphone is actuated by that voltage which, with the earphone applied to the ear concerned, would correspond with the threshold of hearing.

2.65 Reference Equivalent Threshold Sound Pressure Level (Monoaural Earphone Listening) — At the specified frequency, for a specified type of earphone and for a specified pattern of artificial ear. Modal value, at that frequency, of the equivalent threshold sound pressure levels of an adequately large number of ears of otologically normal subjects within the age limits of 18 to 30 years inclusive.

2.66 Hearing Threshold Level or Audiometric Hearing Loss for Pure Tones (for a Given Ear, at a Specified Frequency) — The level difference between the equivalent threshold sound pressure level for that ear and the standard reference equivalent threshold sound pressure level (0 dB).

2.67 Otologically Normal Subject — A person in a normal state of health who is free from all symptoms of ear disease and from wax in the ear canal, and whose hearing for conversational speech is unimpaired.'

(LTDC 5)

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